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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/756,971	01/09/2001	Salman Akram	MI22-1572	7766

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EXAMINER

ZARNEKE, DAVID A

ART UNIT	PAPER NUMBER
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2827

DATE MAILED: 02/05/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/756,971

Applicant(s)

AKRAM, SALMAN

Examiner

David A. Zarneke

Art Unit

2827

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05 January 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 42-79 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) 63-79 is/are allowed.
- 6) ☐ Claim(s) 42-57 is/are rejected.
- 7) ☐ Claim(s) 58-62 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claim 42 have been considered but are moot in view of the new ground(s) of rejection.

Applicant argues that the amendment of the claims restricting the thermal conductivity of the thermally conductive material to be greater than that of elemental copper.

The examiner notes Applicant's argument and cites a new rejection of the claim below using references teaching the use of silver as an equivalent, and even a superior, thermally conductive material.

Regarding claim 45, Applicant's arguments filed have been fully considered but they are not persuasive.

It is argued that MPEP 2144.05(B) is limited to optimizing concentration and temperature only, as in *In re Aller*.

The examiner strongly disagrees with this statement.

First, Applicant is reading MPEP 2144.05(A), not MPEP 2144.05(B), as cited in the rejection. MPEP 2144.05(B) states that routine experimentation can be used on result-effective variables (*In re Antonie* 559 F.2d 618, 195 USPQ 6 (CCPA 1977)). The term result-effective variables would include thickness.

Second, to limit MPEP 2144.05(A) only to *In re Aller* is grossly misrepresenting the entirety of the section. There are many rulings discussed here that emphasize

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several other result-effective variables. To say that concentration and temperature are the only result-effective variables useable under MPEP 2144.05(A) is misunderstanding the intent of this section of the MPEP.

With respect to claim 57, Applicant's arguments have been fully considered but they are not persuasive.

Applicant argues that no motivation for modifying Nakashima and Chen with Wang was provided. The examiner merely states that they can be modified.

The examiner asserts that this motivation was provided in the previous office action and was inadvertently left out of the last office action. It will be included in this action.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 42 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chan et al., US Patent 5,998,860, in view "Silver", Wikipedia free Encyclopedia or Wagner et al., "Easy Heatsink Mods to Drop CPU Temps", Chron USA or "Cooling Fundamentals: Thermal Conductivity" from FrostyTech.com.

Chan teaches a memory module comprising:
providing an insulative substrate (70) with circuitry thereon and an opening there through;
adhering a die (50) to the substrate with an electrically conductive adhesive (60) having circuitry supported thereby; and
electrically connecting the circuit on the die to the circuitry on the substrate with wire bonds (80) extending through the opening (Figure 1).

Chan fails to teach forming a thermally conductive material over at least a portion of the die, the material comprising a thermal conductivity greater than that of elemental copper.

"Silver", Wikipedia free Encyclopedia or Wagner et al., "Easy Heatsink Mods to Drop CPU Temps", Chron USA or "Cooling Fundamentals: Thermal Conductivity" from FrostyTech.com all teach the thermal conductivity of silver as being higher than copper (see highlighted sections).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the silver of "Silver", Wikipedia free Encyclopedia or Wagner et al., "Easy Heatsink Mods to Drop CPU Temps", Chron USA or "Cooling Fundamentals: Thermal Conductivity" from FrostyTech.com in the combined inventions of Chan and

Chen because they all teach that silver has a higher thermal conductivity than copper, is an art recognized equivalent to copper and is the ideal material for ultra efficient heat sinks (FrostyTech, page 2, highlighted section).

The substitution of one known equivalent technique for another may be obvious even if the prior art does not expressly suggest the substitution. Ex parte Novak 16 USPQ 2d 2041 (BPAI 1989); In re Mostovych 144 USPQ 38 (CCPA 1964); In re Leshin 125 USPQ 416 (CCPA 1960); Graver Tank & Manufacturing Co. V. Linde Air Products Co. 85 USPQ 328 (USSC 1950).

Regarding claim 43, Chan teaches the adhesive as being a silver-filled epoxy (3, 61 -4, 35).

Claim 44 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chan et al., US Patent 5,998,860, in view "Silver", Wikipedia free Encyclopedia or Wagner et al., "Easy Heatsink Mods to Drop CPU Temps", Chron USA or "Cooling Fundamentals: Thermal Conductivity" from FrostyTech.com, as applied to claim 42 above, and further in view of Chen et al., US Patent 6,215,180.

Chan fails to teach the placing of a metal foil in physical contact with at least a portion of the die.

Chen teaches a heat dissipating structure comprising a heat dissipating member (59) in physical contact with at least a portion of the die (figure 5).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the heat dissipating member of Chen in the invention of Chan because Chen teaches that heat generated by the chip is dissipated by the member (abstract).

Claims 45, 49-51, 53, 55 and 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chan et al., US Patent 5,998,860, in view of Chen et al., US Patent 6,215,180.

Chan and Chen, both relied upon as taught above, fail to teach the metal foil having a thickness of less than or equal to about 500 microns.

It would have been obvious to one ordinary skill in the art at the time of the invention to optimize the thickness of the metal foil (MPEP 2144.05(b)). One of ordinary skill would perform routine experiments to find the optimal metal foil thickness to perform its function.

The examiner asserts that the specification (page 12, 6-22) teaches the physical contact to be achieved through the use of a conductive epoxy provided between the foil and the die sidewalls. Therefore, the applicant's definition of physical contact with the sidewalls of the die has been met.

Claims 46 and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chan et al., US Patent 5,998,860, in view of Chen et al., US Patent 6,215,180, as applied to claim 45 above, and further in view of Tummala et al., Microelectronics Packaging Handbook, Semiconductor Packaging - Part 11, 2nd Edition, pages 898-901.

Both Chan and Chen fail to teach the use of welding, specifically laser welding, to attach the metal foil to the substrate.

Tummala teaches the use of laser welding to attached metal lids to packages (900, last paragraph).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the laser welding of Tummala in the inventions of Chan and Chen because Tummala teaches that laser welding is attractive "because of its high speed, very limited heat input to sensitive areas, ability to handle unconventional seal geometries, and noncontact nature" (900, last paragraph).

Claim 48 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chan et al., US Patent 5,998,860, in view of Chen et al., US Patent 6,215,180, as applied to claim 45 above, and further in view of Tummala et al., Microelectronics Packaging Handbook Subsystem Packaging - Pad 111, 20d Edition, pages 223-234.

Both Chen and Chan fail to teach the use of an electrically conductive adhesive to adhere the metal foil to the substrate or the die to the substrate.

Tummala teaches using Ag-filled epoxies as electrically conductive adhesives (p. 227-228).

As evinced by Tummala above, electrically conductive adhesives are conventionally known to be used to connect chips to insulative substrates. The use of conventional materials to perform their known functions in a conventional process is obvious. In re Raner 134 USPQ 343 (CCPA 1962).

Claims 52 and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chan et al., US Patent 5,998,860, in view of Chen et al., US Patent 6,215,180, as applied to claim 45 above, and further in view of Wang et al., US Patent 6,226,140.

Both Chen and Chan fail to teach the heat dissipating member as physically contacting the sidewall and also a gap between the sidewall and the heat dissipating member which is filled with an electrically conductive epoxy.

Regarding claim 52, Wang teaches a flip chip scale package comprising attaching a reverse U-shaped heat slug (312) to the die that contacts the sidewalls of the die (3, 24+). Wang's teaching that a space "may exist" means that the space also does not have to exist.

Wang teaches the foil as being in physical contact with the die in keeping with the present application's definition of physical contact (12, 9-17).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the heat slug of Wang in the invention of both Chan and Chen because the increased contact surface area of the slug improves heat dissipation.

With respect to claim 54, Wang teaches that the heat slug is attached to the die using a conductive epoxy (3, 26+).

Claim 57 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nakashima et al., US Patent 5,661 ,086, in view of Chen et al., US Patent 6,215,180, and Wang et al., US Patent 6,226,140.

Nakashima teaches a process of making a plurality of strip lead frames comprising:

forming a connected circuit substrate frame made of glass fabric reinforced epoxy resin (an insulative substrate) having a lead pattern on one face and an opening there through (6, 43+);

forming a connected metals frame and adhering it to a second face of the connected circuits frame;

mounting a die onto the connected metals frame within the opening; and electrically connecting, using bond wires that extend through the opening, the die to the lead pattern (figure 1).

Nakashima fails to teach the die adhering to both the metals frame and the circuits frame.

Chen teaches a heat dissipating structure wherein a structure similar to Nakashima is disclosed (Figure 1) and a structure wherein the die (21) is adhered to both a metal heat dissipating member (26) and an insulative substrate (22) having circuits thereon (Figures 2+).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the method of Nakashima to form the structure of Chen because Chen teaches that the structure of Figure 2 is an alternative to the structure of Figure 1.

Therefore, one of ordinary skill in the art would apply the process of Nakashima to the alternative invention of Chen.

The substitution of one known equivalent technique for another may be obvious even if the prior art does not expressly suggest the substitution. Ex parte Novak 16 USPQ 2d 2041 (BPAI 1989); In re Mostovych 144 USPQ 38 (CCPA 1964) ; In re Leshin 125 USPQ 416 (CCPA 1960)', Graver Tank & Manufacturing Co. V. Linde Air Products Co. 85 USPQ 328 (USSC 1950).

Nakashima and Chen fail to teach the die as comprising sidewalls extending from the insulative substrate and the metal foil adhered to the second surface thereof physically contacting at least a portion of at least one sidewall.

Wang, relied upon as taught above, teaches the foil in physical contact, as defined by the specification of the present application (p12, 9-17), with the sidewalls of the die.

Claims 46 and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chan et al., US Patent 5,998,860, in view of Chen et al., US Patent 6,215,180, as applied to claim 45 above, and further in view of Tummala et al., Microelectronics Packaging Handbook; Semiconductor Packaging - Part 11 2nd Edition pages 898-901.

Claim 48 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chan et al., US Patent 5,998,860, in view of Chen et al., US Patent 6,215,180, as applied to claim 45 above, and further in view of Tummala et al., Microelectronics Packaging Handbook Subsystem Packaging – Part III, 2nd Edition, pages 223-234.

Allowable Subject Matter

Claims 58-62 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 63-74 stand allowed over the prior art, pending final PTO approval of the terminal disclaimer filed 7/3/03.

Claims 75-79 stand allowed over the prior art.

The following is a statement of reasons for the indication of allowable subject matter: these claims incorporate the limitations of objected claims 58-62 into and independent claim.

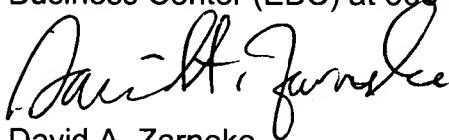
Conclusion

Any inquiry concerning this communication should be directed to David A. Zarneke at (703)-305-3926. The examiner can be reached on M-F 10AM-6PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamand Cuneo can be reached on (703)-308-1233. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

After February 5, 2004, the examiner's phone number will be (571)-272-1937 and his supervisor's phone number will be (571)-272-1957.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



David A. Zarneke
Primary Examiner
February 2, 2004